AF/2700
#17

OIPE JUL 1 5 2002 JC48 PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of **Freed** Serial No. 09/035,944 Filed: March 6, 1998 For: **SYSTEM AND METHOD OF IMPROVING THE DYNAMIC RANGE OF A RECEIVER IN THE PRESENCE OF A NARROWBAND INTERFERING SIGNAL** Attorney's Docket No. 4015-2743	Craver, C. Examiner Group Art Unit 2685 RECEIVED JUL 1 7 2002 Technology Center 2600

Raleigh, North Carolina
July 10, 2002

Box AF
Commissioner for Patents
Washington, D.C. 20231

Appeal Brief

(1) REAL PARTY IN INTEREST

The real party in interest is Ericsson, Inc., the Assignee of the present application.

(2) RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences to the best of Applicant's knowledge.

07/16/2002 CNGUYEN 00000056 09035944
01 FC:120 320.00 OP

(3) STATUS OF CLAIMS

Twenty-four (24) claims have been finally rejected by the Examiner. They are claims 1-24. Applicant appeals from all rejected claims.

(4) STATUS OF AMENDMENTS

Applicant believes that all amendments have been entered.

(5) SUMMARY OF INVENTION

Code Division Multiple Access (CDMA) is a well-known and widely deployed air interface protocol for wireless voice and data communication. CDMA utilizes spread spectrum technology to spread the energy of a transmission over a wide bandwidth, such as 1.23 MHz in the IS-95 standard. Spread spectrum systems offer performance advantages such as increased channel capacity (more users per MHz), reduced susceptibility to multipath fading, increased communication security, and longer battery life due to lower power consumption. However, the wide bandwidth of the transmit and receive channels also makes CDMA systems more susceptible to interference from narrowband signals, such as signals from the prior generation Advanced Mobile Phone System (AMPS) analog cellular communication system.

For technical reasons,[1] an AMPS signal in or near the transmit frequencies may introduce a crossmodulation noise component into the input signal seen at a CDMA receiver. The effect of the crossmodulation is to raise the noise floor of the input signal,

---

[1] *Inter alia*, the use of amplitude modulation in both the CDMA and AMPS systems; the finite isolation between the transmit and receive paths in a duplex filter; and the inherent nonlinearity of components in the receiver front end. The technical details are discussed at length in Appellant's Specification, *see* pp. 1-4.

thus reducing the dynamic range of the receiver. In particular, it is known that a primary culprit in receiver performance degradation is due to third order nonlinearity in the receiver Low Noise Amplifier (LNA). Receiver components have been developed to address this, including a class of LNAs wherein the third order Input Intercept Point (IIP_3) is adjustable. The IIP_3 is an active device characteristic that is extrapolated from a plot of the output RF signal and the third-order crossmodulation noise versus the input RF signal. As the input RF signal is increased, the IIP_3 is a theoretical point where the desired output RF signal and the crossmodulation noise become equal in amplitude. Since the magnitude of the crossmodulation noise is related to the strength of both the wideband CDMA transmit signal and the AMPS interference signal, the typical approach in the art has been to increase the IIP_3 when the transmitter operates at high power, and to reduce the IIP_3 when the transmitter operates at low power. This practice increases the dynamic range of the receiver in the presence of an AMPS signal in a variety of cases. However, it does not address at least the situation wherein a mobile user is relatively close to a CDMA base station – and thus operating its transmitter at a low power level – and a strong interfering AMPS signal is present. In this case, the low IIP_3 of the LNA (set based on the low transmitter power) is insufficient to suppress the crossmodulation noise, resulting in degradation of the received signal.

According to the present invention, the IIP_3 of a CDMA receiver LNA is dynamically adjusted based not only on the operating power of the transmitter, but also on a detected error rate, such as the Bit Error Rate (BER) or Frame Error Rate (FER). With this approach, the receiver may more accurately tune the IIP_3 to maximize the dynamic range of the receiver in the presence of a narrowband interfering signal than

with the more rigid approach of the prior art. In particular, four cases are considered (*see also* pp. 8-9 of Appellant's Specification):

1. When the transmitter is operating at a high power level, both the gain and the IIP_3 are maximized. This mode may be particularly applicable when the user is relatively far from a CDMA base station.

2. When the transmitter is operating at a reduced power level, the strength of the received signal is consulted. If the received signal strength is below a threshold, the LNA gain is maximized and the IIP_3 is minimized. This mode may reflect a user located an intermediate distance to a CDMA base station, but with some interference in the receive path.

3. When the transmitter is operating at a reduced power level and the received signal strength is above the threshold, the LNA gain is minimized and the error rate is consulted to determine the IIP_3. If the error rate is below a threshold, the IIP_3 is minimized. In this mode, a user may be close to a CDMA base station, with clear signal paths and little interference.

4. In the conditions of case 3, if the error rate exceeds the threshold, the IIP_3 is maximized. This mode may be particularly applicable to a user close to a CDMA base station, and additionally close to an AMPS base station or other source of narrowband interference.

The dynamic control of the IIP_3 of a receiver LNA based on the receiver's detected error rate is a novel and nonobvious invention, that maximizes the dynamic range of the receiver in the presence of a narrowband interference signal in a variety of

situations in which prior art methods fail to attenuate the crossmodulation. This feature is recited in claims 1, 8, and 15.

(6) ISSUE

Whether independent claims 1, 8, and 15 are obvious under 35 U.S.C. § 103(a) over U.S. Patent No. 5,758,271 to Rich, *et al.* ("Rich"), in view of U.S. Patent No. 6,134,430 to Younis, *et al.* ("Younis")?

(7) GROUPING OF CLAIMS

Claims 1-24 should be grouped together. All of the claims stand or fall together.

(8) ARGUMENT

A. The Law of Obviousness

The Examiner has the burden under § 103 to establish a *prima facie* case of obviousness. When combining references, the Examiner can satisfy this burden only by showing some objective teaching in the prior art, or knowledge generally available to one of ordinary skill in the art, that would motivate one to combine the relevant teachings of the references. *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596 (Fed. Cir. 1988). Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior

art and not based on applicant's disclosure. *In re Vaeck,* 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). When the references cited by the examiner fail to establish a *prima facie* case of obviousness, the rejection is improper and will be overturned. *In re Brouwer*, 77 F.3d 422, 37 USPQ2d 1663 (Fed. Cir. 1996).

It is error to reconstruct the patentee's claimed invention from the prior art by using the patentee's claim as a "blueprint." When prior art references require selective combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself. *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 227 USPQ 543 (Fed. Cir. 1985). The motivation to combine references cannot come from the invention itself. *Heidelberger Druckmaschinen AG v. Hantscho Commercial Products, Inc.*, 21 F.3d 1068, 30 USPQ2d 1377 (Fed. Cir. 1993). One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596 (Fed. Cir. 1988).

B. The Examiner has failed to make out a *prima facie* case of obviousness.

The Examiner has maintained rejections of all claims under 35 U.S.C. § 103 based on a combination of the Rich and Younis references. Neither of these references, alone or in combination, teaches or suggests Applicant's invention. Furthermore, neither of the references provides any suggestion or motivation for combination with the other, or any reasonable expectation of success in such combination. Nor is such motivation or expectation of success found in the art. Indeed,

even if the references were combined, they would not produce Applicant's invention, absent significant and inventive modification.

The Examiner has simply deconstructed Applicant's claims into their individual elements, and matched each individual claim element up with a purported teaching from one of the cited references, using impermissible hindsight. Nothing supports the proposed combination of references except the teachings of Applicant's disclosure. In short, the Examiner has failed to construct a legally sufficient *prima facie* case of obviousness.

1. The Rich Reference

U.S. Patent No. 5,758,271 to Rich discloses a CDMA receiver wherein the gain is adjusted by the quality of the received signal. That quality may be determined by the ratio Ec/Io (energy per chip / total power spectral density) of the received signal, or by an error rate estimate of the demodulated received signal. Rich further discloses compensating the Received Signal Strength Indicator (RSSI) to account for the increased gain (based on signal quality) that may otherwise alter the detected RSSI. Rich is completely silent as to altering the IIP_3 of the receiver's amplifier to attenuate crossmodulation introduced by a narrowband interference signal.

2. The Younis Reference

U.S. Patent No. 6,134,430 to Younis discloses a programmable dynamic range receiver, the goal of which is to provide adequate performance (in rejecting interfering signals) at reduced power consumption.

> Typically, to minimize degradation due to intermodulation products caused by jammers [i.e., narrowband interference signals], the receiver is designed to have high IIP3. However, design of a high IIP3 receiver requires the active devices within the receiver to be biased with high DC current, thereby consuming large amounts of power. This design approach is especially undesirable for cellular application wherein the receiver is a portable unit and power is limited.

col. 3, lines 26-33. Younis describes the worst-case interference situation with reference to the IS-98-A spurious signal rejection standard for CDMA systems, comprising two "jammers," *i.e.*, interference signals, injected at +900 KHz and +1700 KHz from the CDMA waveform center frequency, with an amplitude 58 dB higher than that of the CDMA signal. col. 11, lines 30 – 67. Younis describes the drawback of a static design capable of adequate performance under these worst-case conditions, and the inventive concept that addresses this drawback, at col. 12, lines 5-17:

> However, in practice, the jammers are present for only a fraction of the operating time of receiver. Furthermore, the amplitude of the jammers will rarely reach the +58 dB level as specified. Therefore, to design for the worse case jammers and to operate receiver in the high IIP3 mode in anticipation of the worse case jammers is a waste of battery power.
>
> In the present invention, the IIP3 of the active devices, in particular [the] LNA and mixer, are adjusted <u>in accordance with the measured non-linearity in the output signal from [the] receiver</u>. In the exemplary embodiment, the non-linearity is measured by the <u>RSSI slope</u> method.

Younis begins with the problem of narrowband signal interference, and recognizes that a fixed, high-IIP_3 LNA addresses the problem but at the expense of excessive power consumption. Younis' invention is the dynamic control of the LNAs' IIP_3 based on the level of non-linearity in the receiver output signal (as measured by the RSSI slope), to reduce power consumption when the high-IIP_3 state is not required. The inventive contribution of Younis is thus not so much a receiver with high dynamic range as one with reduced power consumption, achieved by varying the dynamic range in response to measured system non-linearity.

3. The Examiner Improperly Combined the References

Appellant's invention comprises a CDMA receiver wherein the IIP_3 of the LNA is adjusted based on a detected error rate. Claim 1 is representative:

> 1. An apparatus for improving the dynamic range of a receiver, comprising:
>
> a processor for computing an error rate of a received signal; and
>
> a low noise amplifier with an adjustable input intercept point, wherein the input intercept point is adjusted depending on the computed error rate.

Rich discloses a receiver wherein the <u>gain</u> is adjusted by a detected error rate. Younis discloses a receiver wherein the IIP_3 of an LNA is adjusted by the amount of <u>non-linearity</u> of the received signal (as indicated by the RSSI slope). The <u>only</u> teaching tying these references together is Appellant's claim 1. The Examiner has merely deconstructed the salient elements of claim 1 – the adjustment of an IIP_3 based on an error rate – and picked and chosen among the prior art to find an IIP_3 adjusted by <u>something</u> (Younis), and <u>something</u> adjusted based on an error rate (Rich). This is improper obviousness analysis, as a matter of law. "One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." *In re Fine*, 837 F.2d 1071,1075 (Fed. Cir. 1988). "One does not start with Claim 1 and go to the prior art to see if one can piece together the [claimed invention] from the combination of older things." *Medtronic, Inc. v. Daig Corp.*, 221 USPQ 593, 606 (D. Minn. 1983).

As motivation for combining the references, the Examiner stated, "Younis discloses that a gain control loop benefits from an LNA with an adjustable IIP." Final Office Action, p. 4. However, as discussed above, Younis discloses this benefit <u>only as</u>

opposed to an LNA with a fixed high-IIP_3, as a means to reduce power consumption. Rich is completely silent as to the IIP_3 of its receiver, and certainly does not disclose a high-IIP_3 amplifier that suffers from excessive power consumption. The "benefit" the Examiner ascribes to Younis is utterly inapposite to Rich. As the "problem" of high power consumption by a fixed, high-IIP_3 LNA does not exist in Rich, one of ordinary skill in the art would not be led from Rich to Younis to solve such a problem. Nor has the Examiner identified any other deficiency in Rich that the teaching of Younis would alleviate.

Indeed, the proposition that one of ordinary skill in the art, facing the problem confronting the Appellant at the time of invention, would be led to Rich to begin with, is a dubious one. As discussed, the present invention addresses a deficiency in adjustable IIP_3 LNA receivers wherein the IIP_3 is adjusted based solely on the transmit power level. In at least the case of a user being close to a CDMA base station, with the mobile unit transmitter consequently operating at a reduced power level, the resulting low IIP_3 at the LNA may be insufficient to suppress crossmodulation generated by a nearby narrowband interference signal. The present invention allows more precise control over the IIP_3 – increasing performance over a broader variety of real-world conditions – by adjusting the IIP_3 based on the detected error rate. Rich does not disclose an adjustable IIP_3. The only thing tying Rick to the present invention is that Rich discloses using an error rate to control a receiver parameter: the gain. One of ordinary skill in the art, when faced with a problem and prior to solving that problem, does not go for guidance to a reference that is silent on the problem, but discloses the inventor's eventual solution (applied to a different problem). Only patent Examiners are

led to such references, and only by using the claims as a roadmap to reconstruct the invention from isolated disclosures in the prior art. This is improper hindsight, and does not support a *prima facie* case of obviousness.

> The invention must be viewed not with the blueprint drawn by the inventor, but in the state of the art that existed at the time. . . . From its discussion of the prior art it appears to us that the court . . . treated each reference as teaching one or more of the specific components for use in the [inventor's] system, although the [inventor's] system did not then exist. Thus the court reconstructed the [inventor's] system, using the blueprint of the [inventor's] claims. As is well established, this is legal error.

Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 1138-39 (Fed. Cir. 1985).

4. The Combination does not Teach Applicant's Invention

Even if the combination of Rich and Younis in the manner relied on by the Examiner were proper, the combination fails to teach or suggest Applicant's invention. Rich teaches a <u>variable gain receiver</u>. In particular, Rich teaches that the gain may be varied based on a detected error rate in the decoded signal. Younis teaches a programmable dynamic range receiver, wherein the IIP_3 of an LNA may be adjusted <u>based on the non-linearity of the system</u>, as measured by the RSSI slope. The Examiner has not explained how Rich may be modified by the teaching of Younis.

In fact, Younis <u>teaches away from</u> such a combination. Younis discloses LNAs in a receiver, the LNAs having both gain control and IIP_3 control. The gain control is fundamentally incompatible with Rich. Consider Figure 2, and in particular the RF processor block 1210. RF processor 1210 includes two LNAs 1220a and 1220b, separated by a bandpass filter 1226. "LNAs 1220a and 1220b provide a <u>fixed gain</u>." col. 13, lines 31-32. To provide some level of gain control with fixed-gain LNAs, Younis includes an attenuation pad 1222a, 1222b, and a switch 1224a, 1224b in parallel with

each LNA. By selective actuation of the switches under the control of AGC Control Circuit 1260, the attenuation pads are placed in parallel with the LNAs, altering their effective gain.

In contrast, the gain in Rich is controlled by a variable attenuator 204 and variable gain amplifier 206 (see Figure 2), each of which is controlled by a separate gain control lines 132 and 133, respectively. The gain control signals 132, 133 are generated by a complex array of balanced summers and limiters, based on both a compensated RSSI value 134 and a signal quality metric 130 based on a computed error rate. Since the entire purpose of the Rich receiver is gain control, the addition of fixed-gain, variable-IIP_3 LNAs as taught by Younis would require significant and inventive modification, if indeed it were possible at all.

Even if so, the combination still would not yield the present invention, wherein the variable gain <u>and</u> variable IIP_3 of an LNA are controlled independently by a Digital Signal Processor (DSP). See Figure 3, and Specification, p. 7, lines 24-29.

Conclusion

For the reasons set forth above, all claims being appealed herein are patentably nonobvious over the cited art, and the rejections maintained by the Examiner must be reversed.

Respectfully submitted,

COATS & BENNETT, P.L.L.C.

By: Edward H. Green

Edward H. Green, III
Registration No. 42,604
P.O. Box 5
Raleigh, NC 27602
Telephone: (919) 854-1844

CERTIFICATE OF MAILING

I HEREBY CERTIFY THAT THIS DOCUMENT IS BEING DEPOSITED WITH THE UNITED STATES POSTAL SERVICE AS FIRST CLASS MAIL, POSTAGE PREPAID, ON THE DATE INDICATED BELOW, IN AN ENVELOPE ADDRESSED TO: **BOX AF, COMMISSIONER FOR PATENTS, WASHINGTON, D.C. 20231**.

SIGNATURE [signature]

DATE MAILED: 7-10-02

(9) APPENDIX

Claims

1. An apparatus for improving the dynamic range of a receiver, comprising:

   a processor for computing an error rate of a received signal; and

   a low noise amplifier with an adjustable input intercept point, wherein the input intercept point is adjusted depending on the computed error rate.

2. The apparatus of claim 1, wherein the input intercept point is adjusted based also on a transmit power level.

3. The apparatus of claim 2, wherein if the transmit power level is low, and the computed error rate exceeds a predetermined threshold, the input intercept point is set at a maximum level.

4. The apparatus of claim 2, wherein if the transmit power level is low, and the computed error rate does not exceed a predetermined threshold, the input intercept point is set at a minimum level.

5. The apparatus of claim 2, wherein if the transmit power level is high, the input intercept point is set at a maximum level.

6. The apparatus of claim 1, wherein the computed error rate is a frame erasure rate.

7. The apparatus of claim 1, wherein a gain of the low noise amplifier is adjusted based on a received signal strength.

8. A system for receiving and transmitting signals, comprising:

a transmitting path for processing signals for transmission; and

a receiving path for processing received signals, the receiving path including a low noise amplifier with an adjustable input intercept point and a processor for computing an error rate of a received signal, wherein the input intercept point is adjusted depending on the computed error rate.

9. The system of claim 8, wherein the input intercept point is also adjusted depending on a transmit power level of the system.

10. The system of claim 9, wherein if the transmit power level is low, and the computed error rate exceeds a predetermined threshold, the input intercept point is set at a maximum level.

11. The system of claim 9, wherein if the transmit power level is low, and the computed error rate does not exceed a predetermined threshold, the input intercept point is set at a minimum level.

12. The system of claim 9, wherein if the transmit power level is high, the input intercept point is set at a maximum level.

13. The system of claim 8, wherein the computed error rate is a frame erasure rate.

14. The system of claim 8, wherein a gain of the low noise amplifier is adjusted based on a received signal strength.

15. A method for improving the dynamic range of a receiver, the method comprising the steps of:

computing an error rate of a received signal; and

adjusting an input intercept point of a low noise amplifier in the receiver, depending on the computed error rate.

16. The method of claim 15, further comprising a step of detecting a transmit power level, wherein the input intercept point is selected based also on the detected transmit power level.

17. The method of claim 16, wherein if the detected transmit power level is low, and the computed error rate exceeds a predetermined level, the input intercept point is set at a maximum level.

18. The method of claim 16, wherein if the transmit power level is low, and the computed error rate does not exceed a predetermined threshold, the input intercept point is set at a minimum level.

19. The method of claim 16, wherein if the transmit power level is high, the input intercept point is set at a maximum level.

20. The method of claim 15, wherein the computed error rate is a frame erasure rate.

21. The method of claim 15, further comprising the steps of: detecting a received signal strength; and selecting a gain of the low noise amplifier based on the detected received signal strength.

22. The apparatus of claim 1, wherein the input intercept point is adjusted independently of a change in a gain of the low noise amplifier.

23. The system of claim 8, wherein the input intercept point is adjusted independently of a change in a gain of the low noise amplifier.

24. The method of claim 15, wherein the input intercept point is adjusted independently of a change in a gain of the low noise amplifier.